

in Nebraska caused a suspension of railroad traffic and did great damage to crops. On the 23d the river was falling at Kansas City, Mo., and on the 28th the river was reported rising and near the danger-line at that place. On the 29th the Missouri River was 21.9 feet, 0.9 foot above the danger-line, at Kansas City, and rising, and sections of railroad and bottom lands were under water. Damage was reported above Kansas City at points on the Missouri River in Nebraska, Kansas, and Missouri.

On the 30th the stage of the water at Kansas City was 22.8 feet, a rise of 0.9 foot in 24 hours. The village of Harlem, on the Missouri River opposite Kansas City, was partially sub-

merged, and the residents were moving to higher ground; considerable damage was caused along the water front in Kansas City, and tracts of farming land were under water. On the Kansas side of the river, opposite Saint Joseph, Mo., and at points in Nebraska, the Missouri River was over its banks. During the last few days of the month a part of the Colorado Desert basin in San Diego county, Cal., near the line of the Southern Pacific Railroad, was being rapidly filled with water. At this point there is a great inland basin which is more than 200 feet below the level of the sea at its lowest point. At the close of the month a lake about five miles in width had formed.

### MISCELLANEOUS PHENOMENA.

#### DROUTH.

In parts of southern Louisiana crops, especially corn, were damaged by dry weather. In southwest Mississippi the rainfall was insufficient and badly distributed, and crops of all kinds were suffering. In west-central Alabama drouth injured early corn, cotton, and garden vegetables. In north-east Pennsylvania the month was very dry and many small streams dried up. In Clark county, Ky., crops were reported in a bad condition the early part of the month owing to drouth. A report from Shreveport, La., dated the 6th, stated that crops were greatly in need of rain, and that many cisterns were dry. During the early part of the month the Mohawk Valley, N. Y., suffered severely from drouth; the Mohawk River was at the lowest stage in several years, and many wells and cisterns were dry. Drouth also prevailed the first half of the month in Jefferson, Lewis, Otsego, and Saint Lawrence counties, N. Y., and in Connecticut. In parts of Connecticut, and in Middlesex and Somerset counties, N. J., there was a scarcity of water and great need of rain at the close of the month. In the central and northern counties of Michigan the rainfall was insufficient and pastures, corn, wheat, and hay promised a small yield.

#### SUN SPOTS.

Mr. D. E. Hadden, Alta, Iowa: 1st, 5 groups, 14 spots; new group with faculae by rotation on e. limb. 2d, 4 groups, 8 spots. 3d, 4 groups, 14 spots; new group in faculae e.; faculae disappearing by rotation. 8th, 1 group, 11 spots; large area of faculae by rotation in on ne. limb. 9th, 2 groups, 12 spots; new group e., east of faculae. 10th, 3 groups, 18 spots; new group and faculae by rotation in on e. limb. 11th, 3 groups, 13 spots; group and faculae disappearing by rotation. 12th, 2 groups, 13 spots; large group of faculae by rotation on ne. limb; small group of faculae in on e. limb; 2 groups of faculae on w. limb disappearing by solar rotation. 13th, 4 groups, 17 spots; new group with large spot on edge e. limb by rotation in faculae; other new group e. 14th, 4 groups, 20 spots; groups n. latitude. 15th, 5 groups; faculae 1 day in on e. limb. 22d, 6 groups; faculae by rotation e. limb. 25th, 6 groups, 30 spots; 1 group disappearing by solar rotation. 27th, 7 groups, 34 spots; faculae by rotation in on e. limb. 28th, 5 groups, 22 spots; large spot had umbra and penumbra. 29th, 5 groups, 15 spots; 1 large spot. 30th, 5 groups, 12 spots; haze, could not count spots accurately; group by rotation on e. limb.

Mr. John W. James, Riley, Ill.: the group of the 28th of

May vanished 9th, short of w. edge, faculae taking its place 7th, new group on e. edge, its largest spot estimated 22,000 miles in diameter. 12th, another new group 2 days on e. edge. 14th, large spot and group on e. edge. 16th, new group 3 days on edge; prominent faculae e. of large spot of 14th. 21st, 1 new spot, and 2 new groups near e. edge; new group 3 days from w. edge. 22d, 1 new spot near e. edge; immense areas of faculae near e. and w. limbs; could trace them two-thirds sun's apparent diameter. 24th, 2 new groups of small spots 3 days in on e. edge in s. latitude; these increased rapidly in size, 1 spot reaching an estimated diameter of 22,000 miles in 2 or 3 days. 26th, 1 new spot on e. limb. 28th, 2 new groups n. of spot of 24th, and 1 faint spot with faculae near e. edge.

Mr. H. D. Govey, North Lewisburgh, Ohio: sun spots were observed on the 2d, 3d, and 9th to 30th.

Haverford College Observatory, Pa. (observed by Prof. F. P. Leavenworth):

Date.	Number of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculae.	Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.		
June, 1891.										
1, 10 a. m.	2	2	0	0	...	...	5	32	2	Definition fair; 3 large spots.
2, 11 a. m.	1	1	0	0	...	...	6	35	4	Definition good; 2 large spots.
3, 9 a. m.	0	0	1	3	...	...	4	33	3	Definition fair.
4, 11 a. m.	0	0	1	5	...	...	3	20	1	Definition fair.
8, 11 a. m.	0	0	1	3	...	...	1	11	1	Definition poor.
9, 11 a. m.	1	7	0	0	...	...	2	17	0	Definition poor.
10, 10 a. m.	1	1	0	0	...	...	3	29	2	Definition poor; 1 large spot.
11, 9 a. m.	0	0	0	0	...	...	3	19	2	Definition poor; 1 large spot.
12, 3 p. m.	2	11	0	0	...	...	5	66	3	Definition fine; 1 large spot.
13, 11 a. m.	1	1	1	3	...	...	4	24	3	Definition good; 2 large spots.
14, 10 a. m.	1	1	0	0	...	...	5	39	2	Definition good; 2 large spots.
15, 10 a. m.	1	16	0	0	...	...	6	47	3	Definition good; 2 large spots.
16, 9 a. m.	2	42	0	0	...	...	6	88	2	Definition good; 2 large spots.
17, 9 a. m.	4	12	1	10	...	...	5	100	2	Definition fair; 1 large spot.
22, 9 a. m.	4	12	0	0	...	...	9	69	5	Definition good; 2 large spots.
23, 9 a. m.	1	2	2	14	...	...	7	48	3	Definition good; 3 large spots.
24, 9 a. m.	2	4	0	3	...	...	9	43	3	Definition good; 3 large spots.
25, 9 a. m.	3	18	1	3	...	...	8	54	3	Definition fair; 2 large spots.*
26, 9 a. m.	1	49	1	4	...	...	7	108	3	Definition good; 4 large spots.
27, 8 a. m.	0	0	1	1	...	...	6	56	2	Definition poor; 4 large spots.
28, 9 a. m.	2	10	...	...	...	...	7	70	2	Definition fair; 3 large spots.
29, 9 a. m.	0	0	...	...	...	...	6	61	1	Definition good; 1 large spot.
30, 9 a. m.	1	1	...	...	...	...	7	35	2	Definition good.

\* Immense faculae.

### ATMOSPHERIC ELECTRICITY.

#### AUORAS.

Auroras were reported as follows: 4th, Eastport, Orono, and Kent's Hill, Me.; Sault de Ste. Marie, Mich. 5th, Kent's Hill, Me.; Sault de Ste. Marie, Mich. 8th, Sault de Ste. Marie, Mich. 15th, Westfield, Wis. 25th, Sandwich, Ill.

26th, Farmington, Me. 29th, Amana, Iowa; Farmington, Me. On the 4th, about 1 a. m., an aurora of a grayish blue tint, extending from north to northeast and to altitude about 30°, was observed at Sault de Ste. Marie, Mich. It had the appearance of a brilliant curtain, with numerous bright beams

shooting upward. The maximum intensity occurred about 1.45 a. m., and the display disappeared about 2.25 a. m. Another aurora, extending from north to northeast and to altitude about 20°, was observed at Sault de Ste. Marie, Mich., about 1.15 a. m., 5th. It was of a light bluish tint, with several streamers. The display attained its maximum intensity about 2.05 a. m., and disappeared about 2.45 a. m. A third aurora, extending from north to northeast and to altitude 15°, was observed at Sault de Ste. Marie, Mich., at 12.45 a. m., 8th. It consisted of a pale diffused whitish light and continued until 3 a. m.

#### THUNDER-STORMS.

The more severe thunder-storms reported for the month are referred to under "Local storms."

Thunder storms were reported as follows: East of the Rocky Mountains thunder-storms were reported in the greatest number of states, 32, on the 17th; in 31 on the 3d; in 20 to 30 on the 1st, 2d, 4th, 6th, 9th to 12th, 14th to 16th, 18th to 22d, 26th, 28th, and 29th; in 10 to 19 on the 5th, 7th, 8th, 13th, 23d to 25th, 27th, and 30th. There were no dates for which

thunder-storms were reported in less than 10 states east of the Rocky Mountains.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, 29, in Tex.; on 28 in Fla.; on 27 in Mo. and Nebr.; on 26 in La. and N. C.; on 20 to 25 in Ark., Ga., Ill., Iowa, Ky., Kans., Mich., Miss., Ohio, Pa., S. Dak., Tenn., Wis., and S. C.; on 10 to 19 in Ala., Ind., Md., Minn., N. J., N. Y., N. Dak., Va., W. Va., and Okla. T.; and on 1 to 9 in Conn., Del., D. C., Ind. T., Me., Mass., Mont., N. H., R. I., and Vt. West of the Rocky Mountains thunder-storms were reported as follows: Ariz., 25th to 27th, 29th, and 30th; Colo., 1st, 3d to 5th, 9th, 11th, 12th, 15th, 16th, 18th to 20th, and 23d to 30th; Idaho, 4th, 17th, 18th, 20th, and 26th; Nev., 24th; N. Mex., 4th, 5th, 11th to 13th, 15th, 22d, 25th to 27th, 29th, and 30th; Cal., 1st, 2d, 11th to 13th, 16th, 18th, 19th, 23d, and 24th; Oregon, 12th, 16th to 19th, 21st, 22d, and 24th; Utah, 3d, 12th to 14th, 18th, 24th, and 25th; Wash., 2d and 16th to 18th; Wyo., 1st, 3d, 9th, 12th, 14th, 18th, 20th, 25th, and 26th. There were no states and territories in which thunder-storms were not reported.

### VERIFICATIONS.

#### FORECASTS FOR 48 AND 72 HOURS IN ADVANCE.

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer has authorized forecasts for 48 and 72 hours, covering the 2d and 3d days in advance. These are optional with the forecast official, and are only made when clearly in the public interest, and cover, in all cases, considerable areas of country, and are not confined to localities.

Percentages of verifications of forecasts made for second day in advance. Number of predictions made: weather, 181; temperature, 57. Percentages of verifications: weather, 86.4; temperature, 83.5; weather and temperature combined, 85.9.

Percentages of verifications of forecasts made for third day in advance. Number of predictions made, weather, 40. Percentage of verifications, 96.2.

#### WIND SIGNALS FOR JUNE, 1891.

Statement showing percentages of justifications of wind signals for the month of June, 1891.

*Wind signals*—(Ordered by Professor Cleveland Abbe.)—Total number of signals ordered, 20; justified as to velocity, 13; justified as to direction, 20. All of the signals ordered were cautionary; 17 signals were ordered for easterly winds, and 3 signals were ordered for westerly winds. Percentage of justifications, 41.5.

No cold-wave signals were ordered, and no temperature-fall warnings were issued during the month.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

#### FORECASTS FOR 24 HOURS IN ADVANCE.

The forecasts for districts east of the Rocky Mountains for June, 1891, were made by Professor Cleveland Abbe, Signal

Service, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant John P. Finley, 19th Infantry.

*Percentages of forecasts verified, June, 1891.*

States.	Weather.	Temperature.	Weather and temperature combined.	States.	Weather.	Temperature.	Weather and temperature combined.
Maine .....	84.0	67.7	77.5	Arkansas .....	79.3	75.3	77.7
New Hampshire .....	81.0	68.7	76.2	Tennessee .....	78.0	75.3	76.9
Vermont .....	79.3	74.7	77.5	Kentucky .....	85.0	76.3	81.5
Massachusetts .....	86.0	75.7	81.9	Ohio .....	80.3	76.0	76.2
Rhode Island .....	86.7	72.0	80.5	West Virginia .....	86.7	79.7	83.9
Connecticut .....	89.0	77.3	84.3	Indiana .....	83.3	69.3	80.7
Eastern New York .....	84.3	79.3	82.3	Illinois .....	90.0	73.7	83.5
Western New York .....	82.3	72.0	78.2	Lower Michigan .....	79.3	67.3	74.5
Eastern Pennsylvania .....	90.7	75.3	84.5	Upper Michigan .....	79.3	67.3	74.5
Western Pennsylvania .....	78.0	75.0	76.5	Wisconsin .....	77.3	68.7	72.7
New Jersey .....	87.7	77.3	83.5	Minnesota .....	84.7	66.0	77.2
Delaware .....	87.3	78.3	83.7	Iowa .....	82.0	73.3	78.5
Maryland .....	84.7	73.7	80.3	Kansas .....	81.7	69.7	76.9
District of Columbia .....	83.3	70.0	78.0	Nebraska .....	81.0	72.3	77.5
Virginia .....	84.0	62.3	76.1	Missouri .....	82.0	75.0	79.2
North Carolina .....	86.0	61.3	74.9	Colorado .....	84.0	62.0	75.2
South Carolina .....	86.0	75.0	82.0	South Dakota .....	75.3	58.3	68.5
Georgia .....	86.7	72.3	80.9	North Dakota .....	81.7	72.7	78.1
Eastern Florida .....	89.7	83.3	87.1	Northern California .....	95.0	88.0	92.2
Western Florida .....	85.7	72.3	80.3	Southern California .....	99.0	93.0	96.6
Alabama .....	83.7	74.0	79.8	Oregon .....	85.7	83.0	84.6
Mississippi .....	82.0	68.3	76.5	Washington .....	80.7	83.7	81.9
Louisiana .....	79.0	69.0	75.0				
Texas .....	85.0	81.7	83.7	Monthly percentage ..	83.5	72.1	78.9

In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. The forecasts of temperature in districts east of the Rocky Mountains for June, 1891, were made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day. The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.

### STATE WEATHER SERVICES.

*[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]*

The following extracts and summaries are republished from reports for June, 1891, of the directors of the various state weather services:

#### ALABAMA.

*Temperature*.—Maximum, 104, at Wiggins, 28th; minimum, 41, at Camden, 19th; greatest monthly range, 53, at Camden; least monthly range, 17, at Chepultepec.

*Precipitation*.—The average was 0.42 below the normal; greatest monthly 8.65, at Valley Head; least monthly, 2.02, at Marion.

*Wind*.—Prevailing direction, south.—P. H. Mell, *Auburn, director, State Weather Service, and observer, Signal Service.*

#### ARKANSAS.

*Temperature*.—The mean was 1.2 above the normal; maximum, 103, at Lead Hill, 27th; minimum, 56, at Fayetteville, 9th, and at Rogers, 19th; greatest monthly range, 46, at Lead Hill; least monthly range, 19, at Winslow.